Ecological Survey of Falls Canyon

Candidate Research Natural Area

Angeles National Forest

California

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Wilson and the four peaks to its west form an east-west ridge, the north slope of which is cut by several canyons which open into the "West Fork" of the San Gabriel River. Falls Canyon is the least steep of these tributaries. It flows generally north-eastward to its confluence with the West Fork. This and four other perennial streams in Cedar Canyon, Strayns Canyon and the first mile of Rush Creek run more directly northward. This subtle topographic difference in canyon direction defines the angle of solar exposure and markedly affects the vegetation that exists on those slopes, especially the distribution of Pseudotsuga macrocarpa, the Big-Cone Douglas Fir.

Falls Canyon is approximately twenty miles from Pasadena, and within one hour's travel from most of the Los Angeles basin in light traffic. The Angeles Crest Highway (State Highway 2) provides access to two roads and three major hiking trails that circumscribe the Falls Canyon Candidate Research Natural Area (Figures 1 and 2).

Red Box Road is mostly a gravel road which parallels the 'West Fork' and crosses the mouths of all north-facing canyons. Two private camps (Ah-DA-Hi and Camp Hi Hill) and the Forest Service campground at Valley Forge (Camp Cole) are reached via this road. Red Box Road received moderate to heavy use during weekends in 1980.

Mount Wilson Forest Road begins at Red Box Station at its junction with State Highway 2 and follows the 'Mount Wilson Ridge' from San Gabriel Peak to Mount Wilson. It is heavily travelled by tourists and users of the radio and telescope facilities, however most visitors spend little time and go only to the peak and observatory.

Three hiking trails are the only direct easy access to the forested north slope. They are Valley Forge Trail, Rattlesnake Trail and Gabrielino Trail. The latter trail follows the south side of the 'West Fork'; it was not mapped on the 1972 revised USGS topographic map. Hiking parties were observed on all trails, especially the Gabrielino, during all seven visits to Falls Canyon. All trails are in reasonably good to excellent condition except for precipitous upper parts of Rattlesnake Trail, which has been pioneered around several washed-out sections. Although Rattlesnake Trail is steep in upper Strayns Canyon, it takes less than one day to hike from Valley Forge Camp to Mount Wilson and back.

VEGETATION TYPES

Analysis of aerial photographs indicates three major vegetation types listed here in descending order of their total acreage at Falls Canyon area; their relative proportions are roughly the same in all three proposed boundaries as determined by planimetry of these types on aerial photographs (Table 1).

Vegetation types

1. Quercus chrysolepis (Canyon Oak) - Appears as red-orange colored shrubs with rounded canopies, which cast narrow, rounded shadows on infra-red color photograph.

2. Pseudotsuga macrocarpa (Big-Cone Douglas Fir) - Also has red-orange color but conical in shape with half of the tree shaded, casted a tall, pointed shadow.

3. Chaparral (several mixed forms) - Fine textured, olive-green, casting no shadows.

4. Barren land, landslides or roads are turquoise-blue color.

Descriptions of vegetation types

Quercus chrysolepis occurs in large pure stands on all slopes, exposures and minor drainages. It has a crown cover density near one hundred percent in many areas but varies between 60-100 percent. Within areas mapped as Big-Cone Douglas Fir type the Canyon Oak is often as dominant or more so. Even so, the presence of an individual Big-Cone Douglas Fir, as on the north slope of Mount Disappointment in nearly solid oak stands, renders it no longer Canyon Oak type in this classification.

Pseudotsuga macrocarpa is mostly confined to groves which are restricted to north-northwest through north-northeast facing exposures of 60-80 percent slope. More southerly exposures form sharp barriers to this vegetation type and are used here in defining boundaries between Big-Cone Douglas Fir type and Canyon Oak type. There is nearly complete overlap between these two vegetation types. The extent of Big-Cone Douglas Fir acreage is therefore judged by its mere presence even though its density varies from nine trees per acre to one hundred twenty trees per acre. The perimeter of these groves serves to quantify the current extent of the Big-Cone Douglas Fir population although it is considered part of the more generalized Southern Mixed Evergreen Forest.

Chaparral occurs as 'islands' which uniformly cover southern to southeastern exposures mostly at 3300-4300 feet elevation. The limits of this vegetation type are easily distinguished on the aerial photo and are sharply outlined by surrounding Canyon Oak. Although classified here as one type it is often dominated by one or a few plant taxa.

Barren land includes roads and landslides as well as the less pronounced reduction in vegetative cover from recent fires. The Pine Crest Fire (1979) south of Mount Wilson Forest Road and the Sage Fire (1979) north of Red Box Road are evident on the aerial photo by the general light-blue cast and thin vegetative cover, especially on steep south-facing slopes.

TABLE 1

Acreages of Vegetation Types per each boundary

boundaries*	acreage (total)	Big-Cone acres	Chaparral acres	Canyon Oak acres
1.	957	250	193	764
2.	623	160	101	522
3.	2400	810	305	2095

*For a discussion of these three boundary proposals, see the "Boundaries" section in this report.

PLANT COMMUNITIES

Field checks of the former vegetation types call for a finer division of the plant taxa at Falls Canyon (about 120 taxa) into four major plant associations or communities. These communities correspond closely with those described in Thorne's "Vascular Plant Communities of California"(Thorne 1976) and "Terrestrial Vegetation of California" (Thorne 1977). They include:

1. Southern Mixed Evergreen Forest
2. Transitional or high altitude variation Southern Mixed Evergreen Forest
3. Mountain Talus and Rupicolous plants or 'Ridge Flora'

Description of Communities

1. Southern Mixed Evergreen Forest - Although Quercus chrysolepis is mapped here (map 5) separately from Pseudotsuga macrocarpa, both are considered by Thorne as components of the Southern Mixed Evergreen Forest. His general description seems to describe the situation at Falls Canyon very well. Except for the absence of Woodwardia fimbriata (Chain Fern) and Vitis girdiana (Desert Grape), all taxa in Thorne's community and the habitats in which they occur are precisely this way at Falls Canyon area.

   The densest stands of Big-Cone Douglas Fir are intricately mixed with Quercus chrysolepis, and to a lesser extent, Calocedrus decurrens Incense Cedar) and Pinus lambertiana (Sugar Pine). As Thorne mentions, a number of other trees form a riparian 'sub-community' within the Southern Mixed Evergreen Forest. At Falls Canyon Acer macrophyllum (Big-leaf Maple) and Alnus rhombifolia (White Alder) are mostly confined to the upper tributaries of the "West Fork" with Quercus agrifolia (Live Oak) and Platanus racemosa (Western Sycamore) occurring mostly along the "West Fork". Riparian species include:

Acer macrophyllum	Populus fremontii
Alnus rhombifolia	Quercus agrifolia
Aralia californica	Salix lasiolepis
Boykinia rotundifolia	Umbellularia californica
Platanus racemosa	

   With the exception of chaparral enclaves and a diminutive 'Ridge Flora', the majority of the whole north slope of Mount Wilson Ridge is a single plant community, the Southern Mixed Evergreen Forest, with its components varying in density with local topography and site characteristics.

2. Transitional or high altitude Southern Mixed Evergreen Forest begins to intergrade with the former community on Mount Wilson, the upper part of Strayns Canyon and Rush Creek. These areas are still dominated by Canyon Oak but mixed with Pinus ponderosa (Ponderosa Pine), Calocedrus decurrens and Pinus lambertiana. None of the former tree species is significantly dominant over Quercus chrysolepis or each other.

The extent of this transitional forest is not easily distinguishable on the aerial photo, but does not exceed one hundred acres. Except for their relative paucity at Mount Wilson a case could be argued to include both Ponderosa and Sugar Pine as additional plant communities.

3. Mountain Talus and Rupicolous plants - or, as I have described it, the 'Ridge Flora', occupy a small area of the Mount Wilson Ridge. This community is completely within the Southern Mixed Evergreen Forest and mostly indistinguishable on aerial photos. Its total extent is also less than one hundred acres. This community resembles Thorne's "Mountan Talus" community closely, in fact thirteen of these plants conform exactly to Thorne's classification. The following taxa are found on exposed rock outcrops or stabilized scree especially noticeable along rock faces on the Mount Wilson Forest highway. One plant in this list is considered rare but not endangered and is discussed later. This entire suite of plants is, however, very specialized to the ridge climate and is probably not abundant anywhere. A partial list of plants includes:

Arabis sparsiflora var. arcuata
Brickellia californica
Castilleja martinii var. ewanii
Diplacus calycinus
Dudleya cymosa ssp. minor
Eriogonum saxitile
Haplopappus cuneatus
*Heuchera elegans
Hulsea heterochroma
Leptodactylon californicum ssp. glandulosum
Mentzelia laevicaulis
Poa scabrella
Silene parishii
Turricula parryi
Zauschneria californica ssp. latifolia

4. Chaparral - at Falls Canyon is highly variable and is best described as "Mixed Chaparral" (Thorne 1973). On certain slopes some mixed chaparral components exist as pure stands, these include Arctostaphylos glauca (Big-berry Manzanita), Cercocarpus betuloides (Mountain Mahogany), Quercus wislizenii var. frutescens (Interior Live Oak) and Adenostoma fasciculatum (Chamise). Other plants of this community are of much lower relative dominance, not forming pure stands.

Chaparral was confined to island-like enclaves surrounded by Canyon Oak rather than by Big-Cone Douglas Fir. Its components intergraded only slightly into the other plant communities. Big-Cone Douglas Fir had, however, established scattered individuals on some steep slopes which were otherwise covered sparsely by chaparral (see photo, Appendix 5). Most chaparral is very mature with little diversity and very heavily loaded with dead material. Arctostaphylos glauca and Cercocarpus betuloides occur as small trees in these stands, fifteen to twenty feet tall.

*sensitive plant described in Sensitive Plant Taxa section.

SOILS AND GEOLOGY

Falls Canyon area generally covers one continuous mesozoic granitic rock type immediately to the south of the San Gabriel fault, which runs approximately along the West Fork of the San Gabriel River. As such, the soils are also mostly of one family, the Stukel, Sur-Winthrop complex. This family of soils are derived from colluvial deposits of weathered grantic rock on mountain slopes of 60-80 percent. A small area with soils of the Green Bluff family occupies Mount Wilson Peak area. The family names in this classification were originated in a recent unpublished study of the soils of the Angeles National Forest by Dave Gigar and Tom Ryan.

Sur soils are often sixty inches or more in depth, medium acid to neutral and excessively well-drained. In fact the soil is dry between 8-25 inches from June through September. Erosion hazard maximum is very high as is evidenced by natural slides which have occurred in several areas. Some slides have been in undisturbed areas such as NW 1/4 NW 1/4 section 19 and SW 1/4 SW 1/4 section 19, both areas in T 2 N and R 1 W on Mount Wilson USGS quandrangle map. Below Occidental Peak, however, where roads cross natural drainages, slippages and slope failures have been much accelerated.

Stukel, Sur- Winthrop and Greenbluff soils have been given the taxonomic soil description of Entic Haploxerolls and Typic Xerochrepts. They are both considered as new soils which are very dry part of the year, and have a high organic matter content. The Sur-Winthrop complex is considered to be a Mollisol by the former taxonomic name which in fact relates Falls Canyon soils to deep rich soils more often found in grasslands. Despite their recent and highly erosive nature the soils of Falls Canyon area are also relatively deep and rich with a deep humus layer.

FOREST COMPOSITION

METHODS

The point quarter method of vegetation sampling (Cox 1972) was used at Mount Disappointment, Strayns Canyon, Rush Creek and Valley Forge Campground area to obtain some information about three populations in typical Big-Cone Douglas Fir stands. Since trails are the only access to most of these stands, point quarter sites were conducted within each of the major stands at regular intervals along these trails and offset in a random direction and distance. Measurements were made with a diameter tape, biltmore stick and increment borer. Many portions of the groves are inaccessible however, so sampling sites were sought that resembled the average overall densities as they appear in the 'dense' and sparse' phases of Big-Cone Douglas Fir stands on aerial photos. Data was collected first for all tree species present at the site and then for Big-Cone Douglas Fir alone, with twenty sites in each density phase.

RESULTS

Quantification of the differences in overall tree density and especially of Big-Cone Douglas Fir does show a range of difference between the sparse stands such as at Mount Disappointment and the denser stands in Strayns Canyon and Rush Creek (Table 2).

At Mount Disappointment and Valley Forge Campground Big-Cone Douglas Fir represents 25 percent of the tree species. Oak is the most dominant tree species in this sparse phase and is often twice as abundant. Thus, despite the overall visual dominance of the Big-Cone Douglas Fir to the ground observer in this phase, it is mostly an oak forest. Most oaks were multi-trunked which has been inferred as evidence of past fire induced resprouting where oaks form large clones (McDonald and Litrell 1976). This sparse phase is taken to be typical of the smaller stands of Big-Cone Douglas Fir throughout much of its range in the San Gabriel Mountains.

Strayns Canyon and Rush Creek comprise a less common 'dense phase' of forest where Big-Cone Douglas Fir represents 48 percent of the total forest trees. The average height and diameter of trees is reduced, but not appreciably in this phase. The average density of Big-Cone Douglas Fir and of other trees is about twice that of the sparse phase. To the subjective observer, this forest resembles a more northern coniferous type which, although unique to the San Gabriels, is reminiscent of the Douglas Fir (Pseudotsuga menziesii) forests at the same altitude on the Sierran west slope. This contrast, although subjective, is somewhat borne out by the densities and tree species mixtures in these two phases. The difference between this dense phase and sparse phase of Southern Mixed Evergreen Forest is unusual even in the San Gabriels, and surprising when one hikes past chaparral and oak covered slopes into the Big-Cone Douglas Fir and Incense Cedar in Strayns Canyon.

TABLE 2. Condensed Stand Analysis Data

Mount Disappointment and Valley Forge Area

	# trees	avg. dbh	avg. spacing	avg. height	avg. basal area/acre	avg. trees/acre	avg. % total forest trees
*Pm	41	26"	46'	65'	70 sq. ft.	21	25%
0	42	16"	26'	40'	91 sq. ft.	64	

Strayns Canyon and Rush Creek

Pm	34	23"	29'	55'	150 sq. ft.	53	48%
0	42	15"	20'	33'	135 sq. ft.	110	

*Pm- Pseudotsuga macrocarpa
0 - all forest trees

Comparison of these abundance and density figures with Big-Cone Douglas Fir in other studies of this species shows a higher number of trees per acre (76 trees/acre) in some stands at a level site, and slightly more trees (66 trees/acre) on a similar northern exposure (Bolton and Vogl 1976). This compares with 53 trees/acre in Strayns Canyon. In a study at Lytle Creek area in Camp Angeles about 134 trees/acre were reported. This stand was 33 percent Abies concolor (White Fir) with about 22 percent of the trees Pseudotsuga macrocarpa and about equal proportions of Quercus kelloggii (Black Oak) and Q. chrysolepis (Vasek et al. 1974).

Denser stands of Big-Cone Douglas Fir do exist in some other parts of the peninsular and transverse mountain ranges. In fact, the supposed largest known tree of this species is 91 inches dbh and 173 feet tall at San Antonio Canyon, which is in Angeles National Forest (Gause 1966). Stands of this character are indeed few according to an inventory of Big-Cone Douglas Fir by aerial photographs. Mount Wilson area was singled out as one of the few large, dense forests of Big-Cone Douglas Fir (personal communication, Richard Minnich).

GROWTH RATES

Twenty increment cores were taken from the Fall Canyon area to determine rates of growth in both density phases of Big-Cone Douglas Fir (Appendix 2). Data from point quarter samples were also used to compare the differences of diameter classes in these two density phases. The average ages for the following figures were based on the choice of representative trees in their respective stands. However, with a sample size of ten in each phase, only the general characteristics of this forest should be inferred.

The fastest growth rate observed was 4 mm ring width per year (0.16") from a 75 year old, 60 foot tall, 25" dbh Big-Cone Douglas Fir in Strayns Canyon. Near this same site stood the tree with the largest observed dbh of 54" at about 98 feet in height, however this tree was not cored. This same grove yielded the oldest observed tree; 384 years of age, 100 feet in height with a dbh of 40 inches. Early rings of this oldest tree averaged only 1 mm/ring and recent rings (circa 1970) average 0.5 mm/ring. Thus, one of the oldest and largest trees and probably many others at this site, had never demonstrated the rapid growth of more modern trees under optimal growth conditions.

Among trees with the most vigorous growth rates are many much smaller, stunted trees of equal and younger age. For example, Big-Cone Douglas Fir in Strayns Canyon averaged 23" dbh and about 200 years of age. At the same elevation and exposure a tree with a 25" dbh was almost half the age of other trees with the same diameter.

Topographic differences or perhaps exposure makes considerable variation in local growth rates. However there is a slight increasing trend in growth rate between Big-Cone Douglas Fir from the lower elevation Mount Disappointment and Valley Forge stands to the Strayns Canyon and Rush Creek stands. Overall diameter seems to be about equal in both density phases.

TABLE 3. Condensed Increment Core Data
(for raw data see Appendix 2)

	Strayns Canyon	Mount Disappointment
average ring width	2.4 mm (0.09")	2.0 mm (0.08")
average dbh	23"	22.8"

These data do not necessarily show enough detail to accurately analyze the growth dynamics of this forest. Overall diameter attained in the 'dense phase' of Pseudotsuga macrocarpa forest is a measurement that averages the growth rate of a very old stand. Growth rates have undoubtedly changed many times in these 300-year old trees. Thus the average overall growth rate may be high, but may have also declined in recent history after the forest canopy closed. Although growth rates vary, they remain relatively high in both the 'sparse phase' and the 'dense phase' of Big-Cone Douglas Fir forest.

DIAMETER CLASSES

Pseudotsuga macrocarpa that were sampled by point quarter vegetation analysis were categorized according to four diameter classes as in Bolton and Vogl (1969). Some very old stunted trees do not accurately reflect their age merely by diameter measurements. The distribution of approximately 150 trees among these four diameter classes does, however, indicate differences between the two forest density phases. The 'sparse phase' is mostly composed of the smaller diameter classes; 45 percent were in the 4"-16" class. The 'dense phase', however, had only 34 percent in this diameter class. A more detailed analysis of diameter classes with increment borings correlated with stand analysis is beyond the scope of work of this study. Such elaborate methods are needed to accurately study changes in composition, growth rates and regeneration.

TABLE 4. Diameter Classes Represented in Point Quarter Plots

diameter classes	Mt. Disappointment/Valley Forge	Strayns Cyn/Rush Cr.
4" - 16"	45 trees	18 trees
17" - 28"	20 trees	15 trees
29" - 41"	28 trees	16 trees
42" +	7 trees	4 trees

REGENERATION

Many seedlings of Pseudotsuga macrocarpa, Quercus chrysolepis and other trees were present in both the sparse and dense phases of Southern Mixed Evergreen Forest. Seedlings of the Big-Cone were abundant within the shaded canopy, in forest openings, on stabilized road cuts and in natural slide areas. This forest occurrence of Big-Cone seedlings in dense forest is similar in other studies of this species. The ability to have shade-tolerant seedlings that can regain local dominance suggests that this forest type is self-perpetuating when the forest reaches the dense phase. The latter two occurrences of seedlings in new openings and slide areas is a good demonstration of Big-Cone Douglas Fir's ability to colonize or pioneer disturbed areas.

The origin and distribution of the current forest is much more complex than the recent fire history would indicate. The Fire Atlas at Oak Grove USFW District Office recorded fires in 1980 and again in 1900 which together burned the entire Falls Canyon area. The high frequency of mature trees in the large diameter classes is evidence of the very old origin of much of the large Big-Cone Douglas Fir stands. Trees which feasibly originated as seedlings from those century-old fires are at best only a portion of the Pseudotsuga macrocarpa population at Falls Canyon.

PATHOLOGY

Many of the taller trees on Mount Wilson Ridge have dead tops and an occasionally stunted appearance. This phenomenon is common among tall Pseudotsuga macrocarpa, Pinus ponderosa and P. lambertiana trees in upper Strayns Canyon but it is not evident in lower stands. It looks as though most are from lightning strikes since many of those trees had typical lightning scars. It is also probable that stunting occurs as a result of reduced growth rates along the climatic extremes of Mount Wilson Ridge. Resprouting from the bole of the tree from these lightning strikes, fires or perhaps other stresses is common throughout both groves (see photo, Appendix 5). Some resprouts were old enough to have recovered completely and could only be detected by a few dead lower limbs and burn scars at the base of the bole.

On some young trees near the center of Strayns Canyon, the tips and buds of numerous Pseudotsuga macrocarpa branches had brown needles. Others were found on some trees in an open stream channel in upper Strayns Canyon. No boring or insect damage was evident in several specimens analyzed. This occurrence was not seen anywhere else at Falls Canyon area. Levels of high altitude smog are often very severe at Mount Wilson. The exact cause of the brown needles is unknown, but smog damage is very possibly present in this forest (pers. comm. Paul Miller).

A relatively common form of hyperparasitism was discovered on some Quercus chrysolepis at the head of Strayns Canyon. This is a secondary or even later infection by a bacterium that causes dark sap to ooze from the acorns. This bacterial infection is thought to be of the genus Erwinia known as "Drippy nut disease". It is of debatable importance since this infection follows previous gall wasp infection and does not have the ability to initiate the infection itself. Such gall infections are common but do not occur in epidemic scale proportions. The significance, if any, of this condition, is usually as an inconvenience to man when sap drips on cars or houses (pers. comm. Dave Faulkner).

SENSITIVE PLANTS

Two sensitive plant taxa were identified from the Falls Canyon area: Heuchera elegans (Urn-flowered Alum Root) and Boykinia rotundifolia (Round-leaved Boykinia).

In addition I checked all plant collections made during the study against the potentially present plants in List 1 and 2 of the California Native Plant Society's Inventory of Rare Plants (CNPS 1980). These possibly present rare plants were added to the existing Angeles Forest sensitive species list in Appendix 3. Plants were chosen for this new list if their range comes close to the San Gabriel Mountains and if the habitats seemed appropriate to Falls Canyon area. This new list is in Appendix 4.

Heuchera elegans Abrams.

The Urn-flowered Alum Root is a prominent component of the stabilized rock outcrops along Mount Wilson Road, in Strayns Canyon and Rush Creek (see photos, Appendix 5). Although portions of its habitat are both naturally and artificially disturbed, this plant seems to be stable or increasing in its population at Falls Canyon area. Current management of this road appears to favor this plant. Road improvements that may have temporarily disturbed some populations of Heuchera have apparently been infrequent enough that this plant has re-established or invaded many cliffs and steep rock faces created by such construction. The Mount Wilson road was completed circa 1924, so it seems that most road cuts have had nearly sixty years to become revegetated. The erosion potential of these sites is considerable, therefore any large scale construction or alteration of stabilized road cuts could pose a threat to Heuchera elegans in the vicinity of Occidental Peak. Weed control programs along this road should be reviewed to prevent inadvertent 'control' of Heuchera and its associated Talus and Rupicolous Plant community. Populations of Heuchera within undisturbed forest show no signs of disturbance or erosion hazard, and have little likelihood of impact from management practices.

The rarity code for Heuchera elegans given by the California Native Plant Society is 1-1-1-3. This signifies that although rare it is not considered endangered at this time. The plant shows signs of population stability or increase in its known range. It is known only from California in two counties, Los Angeles and San Bernardino, and only in the San Gabriel range.

Boykinia rotundifolia Parry.

The Round-leaved Boykinia is frequent along streamsides especially near the West Fork of the San Gabriel River. It occurs along Red Box Road near Camp Hi Hill, above Valley Forge campground and at most stream crossings along the Gabrielino Trail. At Falls Canyon this plant occurs as an associate of the riparian sub-community of Southern Mixed Evergreen Forest with Acer macrophyllum, Alnus rhombifolia, Umbellularia californica, Toxicodendron diversilobum (Poison-Oak), and Aralia californica (California Aralia). Erosion hazards are not prominent in these densely wooded, deep soils where slopes are much less steep than upstream. Plants were frequently grazed, probably by deer, however this plant is well distributed in Falls Canyon area and not likely to be impacted by any current management practices or policies.

The California Native Plant Society rarity code for Boykinia rotundifolia is 1-1-1-3; this signifies that although rare, it lacks any specific endangerment factors at present and appears to be stable or increasing in numbers. It is known from the following counties within California only: Los Angeles, San Bernardino, Riverside, Orange, San Diego, Santa Barbara and Ventura.

INTRODUCED PLANTS

Many introduced plant species occur at Falls Canyon area especially along roads and on Mount Wilson and at Red Box Station. Most are naturalized weeds that are suitable to disturbed sites. A few have been planted for erosion control and beautification.

Four of these introduced species could have been interpreted as natural components of the high elevation Southern Mixed Evergreen Forest except that these plants were all relatively young trees and growing in rows along Mount Wilson Road. These introductions include Pinus attenuata (Knobcone Pine), Pinus coulteri (Coulter Pine), Fraxinus dipetala (Flowering Ash), Quercus kelloggii (Black Oak) and Populus fremontii (Fremont's Cottonwood).

The Black Oak is perhaps Quercus X morehus (Oracle Oak) which is a hybrid reputedly between Q. kelloggii and Q. wislizenii (Interior Live Oak), except that the Black Oak is not present elsewhere on Mount Wilson. The two trees found were very young with no fruit. These specimens were located at the beginning of the hiking trail to Mount Lowe south of San Gabriel Peak near plantings of Flowering Ash, Calocedrus decurrens (Incense Cedar) and some other plantings along Mount Wilson Road and are therefore thought to be planted.

Another group of introductions have been planted also along roads and at campgrounds that are obviously non-native. These include Spartium junceum (Spanish Broom), Robinia sp. (Locust), Cistus sp. (Mediterranean Rock-Rose), Lolium perenne ssp. multiflorum (Italian Ryegrass) and Vinca sp. (Periwinkle). Although Spartium junceum is considered potentially invasive and weedy it has not extended much beyond the places to which it has been introduced. It should be controlled if it does begin to naturalize beyond its introduced sites into the native vegetation, and it should not be introduced elsewhere. Lolium perenne ssp. multiflorum is known to be very competitive with native plant species. It was shown to reduce the number of native plant seedlings in a controlled post burn seeding experiment on Otay Mountain in San Diego County (Clay Gautier, unpubl.). It has persisted in some disturbed wet sites at Falls Canyon but is not common. Reseeding with Italian Ryegrass subsequent to a burn at Falls Canyon could considerably reduce the success of native tree seedlings at the time that their success is most crucial. Therefore it is not recommended that Italian Ryegrass be used within any areas designated as Research Natural Areas. All other introductions are similarly limited and do not seem apt to naturalize into the Southern Mixed Evergreen Forest.

RECOMMENDATIONS

RESEARCH NATURAL AREA BOUNDARIES

Three boundaries will be discussed here, two of which were proposed previous to this report. This third boundary proposal seeks to maximize the acreage of Big Cone Douglas Fir which is the principal point of interest at Falls Canyon Candidate RNA.

BOUNDARY 1

This boundary was first proposed on June 28, 1973 and is the boundary that accompanied the purchase order for this study (Figure 3). It suggests a 957 acre RNA which includes Big-Cone Douglas Fir stands in lower Falls Canyon and in Cedar Canyon. Most of the Mount Disappointment and all of Strayns Canyon and Rush Creek populations are outside this boundary.

BOUNDARY 2

This boundary proposal was found on file at Oak Grove USFS Station and was dated October 20, 1976. It reduces the RNA to 623 acres. The boundary line has been recessed from natural topographic features and man-made structures such as roads and trails by about 200-500 feet. This recessing eliminates most unnatural features from the RNA except for part of the Valley Forge Trail. The total area also excludes part of the Big-Cone Douglas Fir in Cedar Canyon, but it includes about forty acres of the Strayns Canyon population.

BOUNDARY 3

This new boundary was specifically chosen to include the densest and largest Big-Cone Douglas Fir stands and Ridge Flora which were omitted from the former proposals (Figure 3). This boundary encloses about 2400 acres with the inclusion of several stands of Pseudotsuga macrocarpa and the Ridge Flora. New inclusions of this boundary proposal are:

1. Strayns Canyon Big-Cone Douglas Fir stand - 142 acres.
2. Rush Creek Big-Cone Douglas Fir stand - 233 acres.
3. Mount Disappointment's north slope with Big-Cone Douglas Fir - 150 acres.
4. Occidental Peak and part of Mount Wilson Ridge including Ridge Flora - 60 acres.

DISCUSSION

A detailed analysis of all potential alternatives for new boundaries could include or exclude a large variety of features such as roads, existing fuel breaks and natural resources. Such a thorough analysis is beyond the scope of this report. An attempt is made here to suggest an improved boundary that maintains the ecological integrity of the Big-Cone Douglas Fir and Ridge Flora.

with Boundary Proposal 3. Figure 6 shows the differences between Boundary Proposals 2 and 3 in this respect.

The inclusion of the above four features in Boundary Proposal 3 piece together the whole Mount Wilson to Mount Disappointment ridge and north slope starting on the east at Red Box Gap. As such, this RNA boundary more accurately defines the full extent of Big-Cone Douglas Fir habitat and its watershed.

Boundary 3 is diagrammed on Figure 3. Its *southern border* is formed by a ridge that runs from Mount Wilson to Mount Disappointment. From there the boundary continues north to Red Box Station along a natural ridge with Mount Disappointment road constituting the *western border*. The West Fork of the San Gabriel River forms the *northern border* and encloses the watershed of the entire generalized northern slope within the RNA. A fuel break remaining from the Monrovia fire (circa 1953) outlines the eastern limit of Rush Creek's Big-Cone Douglas Fir stand and is suggested here as part of the *eastern border*. From the edge of Rush Creek the boundary is drawn north along a ridge confining to its west the lower part of the Rush Creek watershed.

The roads, private property and other inclusions in the third boundary proposal are perhaps undesireable. Normally, such features are avoided in choosing an area for preservation as an RNA. The presence or absence of such features in this RNA does not, however, reduce their impact on its potential perpetuity. These same features make Falls Canyon accessible and contribute to its availability as well as to potential threats. For example, eroding slopes adjacent to Mount Wilson Road have undermined some Big-Cone Douglas Fir habitat. This same road has exposed some open rocky habitats and where they are stabilized near Occidental Peak, the Ridge Flora and some Big-Cone Douglas Fir have regenerated. Both these effects warrant the inclusion of Mount Wilson Road in the management plans if not also within the boundaries of any Research Natural Area.

FIRE POLICY

The likelihood of a major fire on the north slope of Mount Wilson Ridge is probably equal with respect to the areas enclosed by all three boundaries. The mixture and age class of vegetation types though varied, is essentially equal throughout these three sections of the north slope. The ridge as a whole would have to be considered in the event of a major fire anywhere on the north slope and fire lines along any intermediate parts of the slope would be very tenuous and probably hazardous. The Mount Wilson Ridge has been used as a fire front for the Pine Crest Fire in September 1979, within which it stopped or was contained. This ridge with its expensive electronic and telescopic facilities will undoubtedly continue to be high priority in fire protection regardless of whatever management policies pertain to the RNA. This incidental fire protection should be considered in evaluating any potential effects to the natural biological integrity of the RNA.

Considering its regenerative and resistant fire adaptations, the Big-Cone Douglas Fir has undoubtedly been significantly influenced and maintained by fire. The modern distribution has most likely been largely altered by the frequency and severity of fires. All available information indicates that in many locations, Pseudotsuga macrocarpa has been depleted or eliminated directly

by modern fires. The San Bernardino National Forest is initiating policies to manage or recover some of its Big-Cone Douglas Fir stands in an effort to salvage some of its remaining stands (pers. comm. Jeanine Derby).

At Falls Canyon area Big-Cone Douglas Fir in the 'sparse phase' is interwoven with Quercus chrysolepis and chaparral and would be expected to be largely killed in an intense fire. Regeneration after such a fire would depend mostly on seedlings and would require a relatively long interval (50-100 years) before such seedlings would again dominate other vegetative types. The fuel loading of Big-Cone Douglas Fir forest in the 'dense phase' is relatively light, and shrub understory is very discontinuous. Fires have been observed to "burn out" or skip over such groves. Such fortuitous fire exclusion of dense Big-Cone Douglas Fir from fires is certainly not assured, but the evidence at Falls Canyon indicates that such groves have been impacted by fires and that this 200-300 year old forest has survived fires largely intact.

Seedlings are reported to have highest success in both burned areas and under mature Big-Cone Douglas Fir forest. Perhaps fire is not necessary as a source of new propagules as with species of closed-cone pines. Fire exclusion would therefore not seem to have any degrading or senescing affect on the Big-Cone Douglas Fir forest.

If fire lines were bulldozed in this extremely erosive Mount Wilson soil the stability of the forest could be significantly upset. Landslides along portions of the Valley Forge fuel break (parallel and east of Valley Forge Trail), have not stabilized and are largely uncorrectable. It is not recommended that such fire control techniques be employed within or up-slope of the existing RNA. Preventative measures such as "shaded-fuel breaks" or low intensity prescribed burning outside RNA boundaries would be preferred alternatives to the use of fuel breaks.

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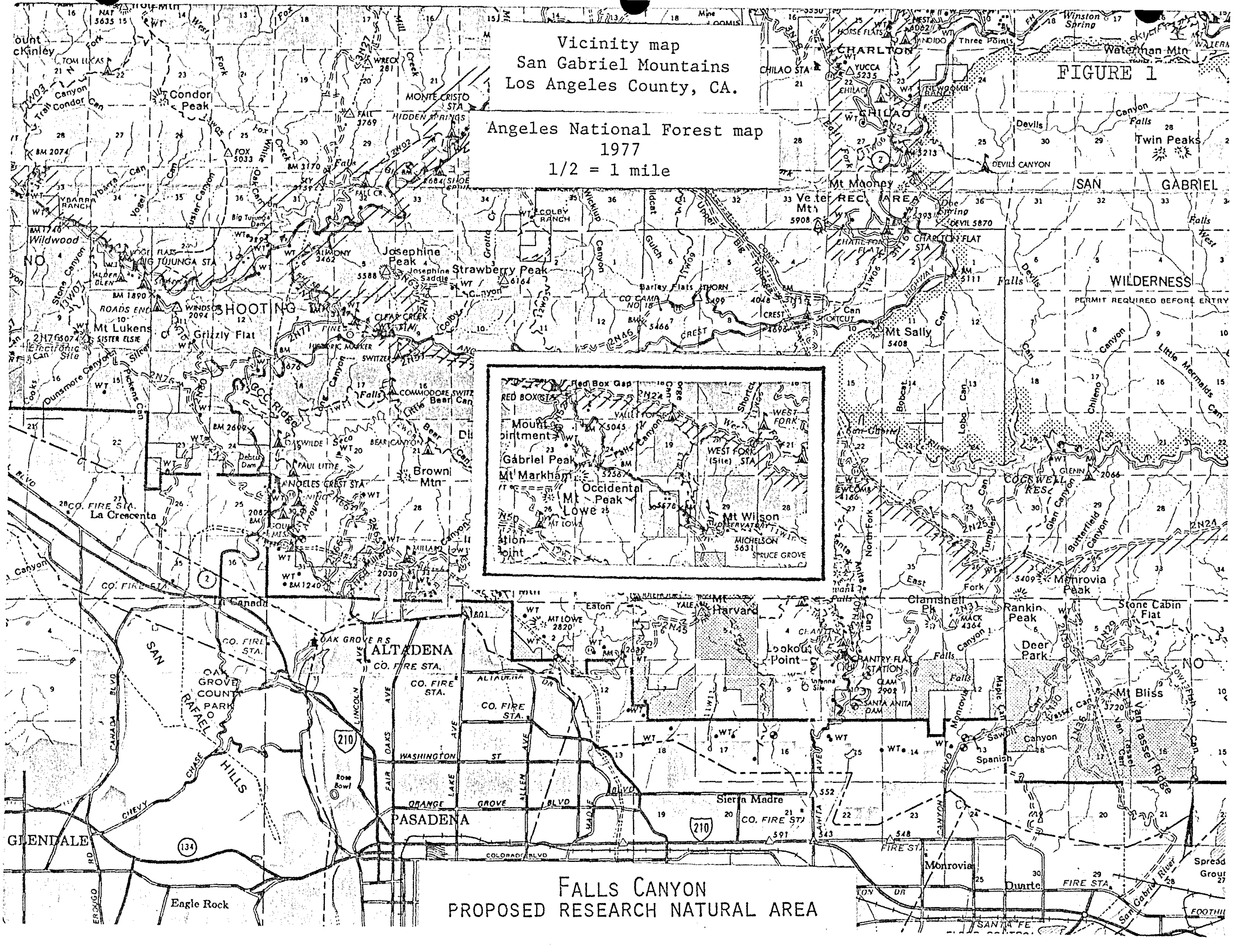


Vicinity map
San Gabriel Mountains
Los Angeles County, CA.

Angeles National Forest map
1977
1/2 = 1 mile

FIGURE 1

FALLS CANYON
PROPOSED RESEARCH NATURAL AREA

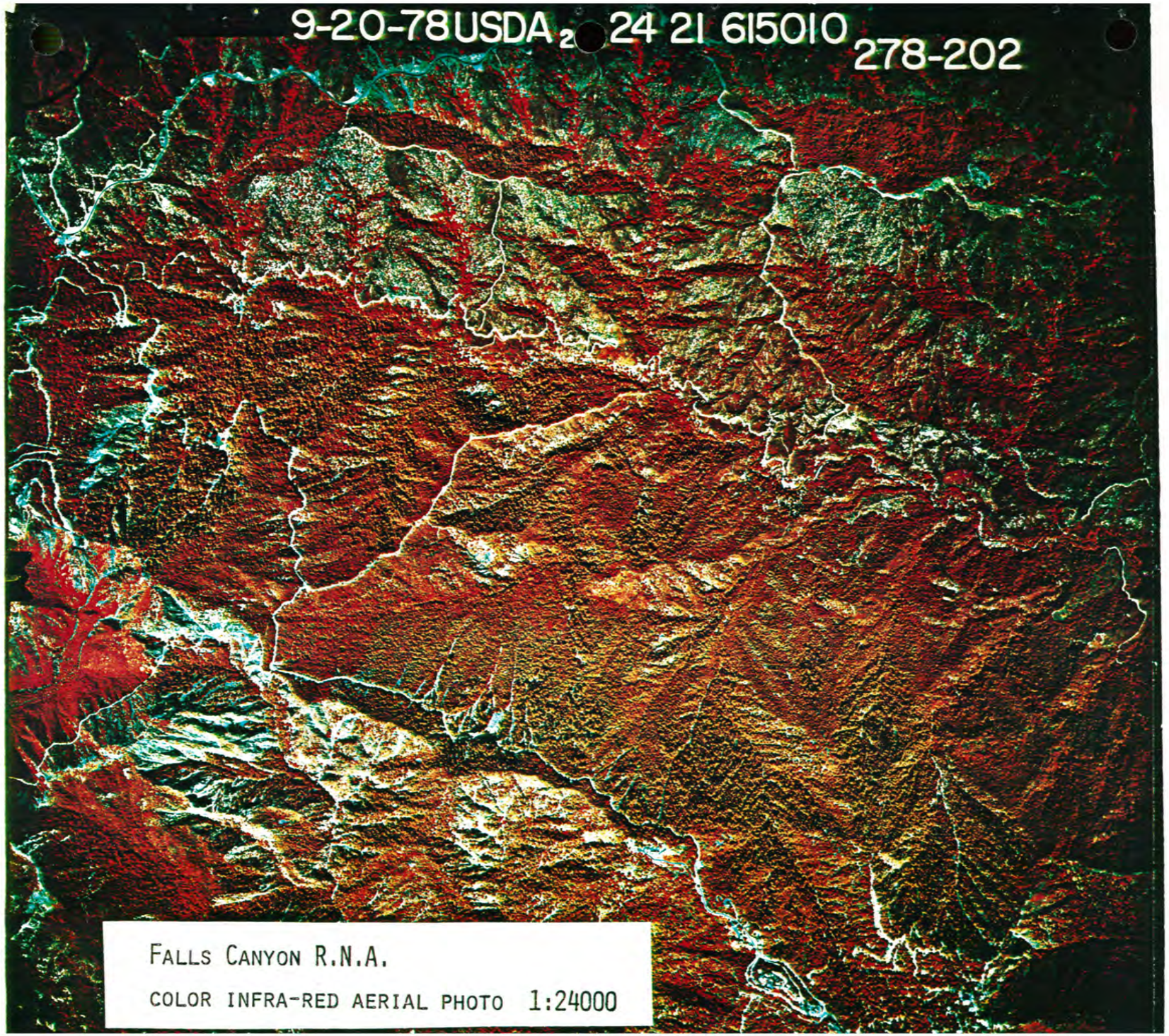
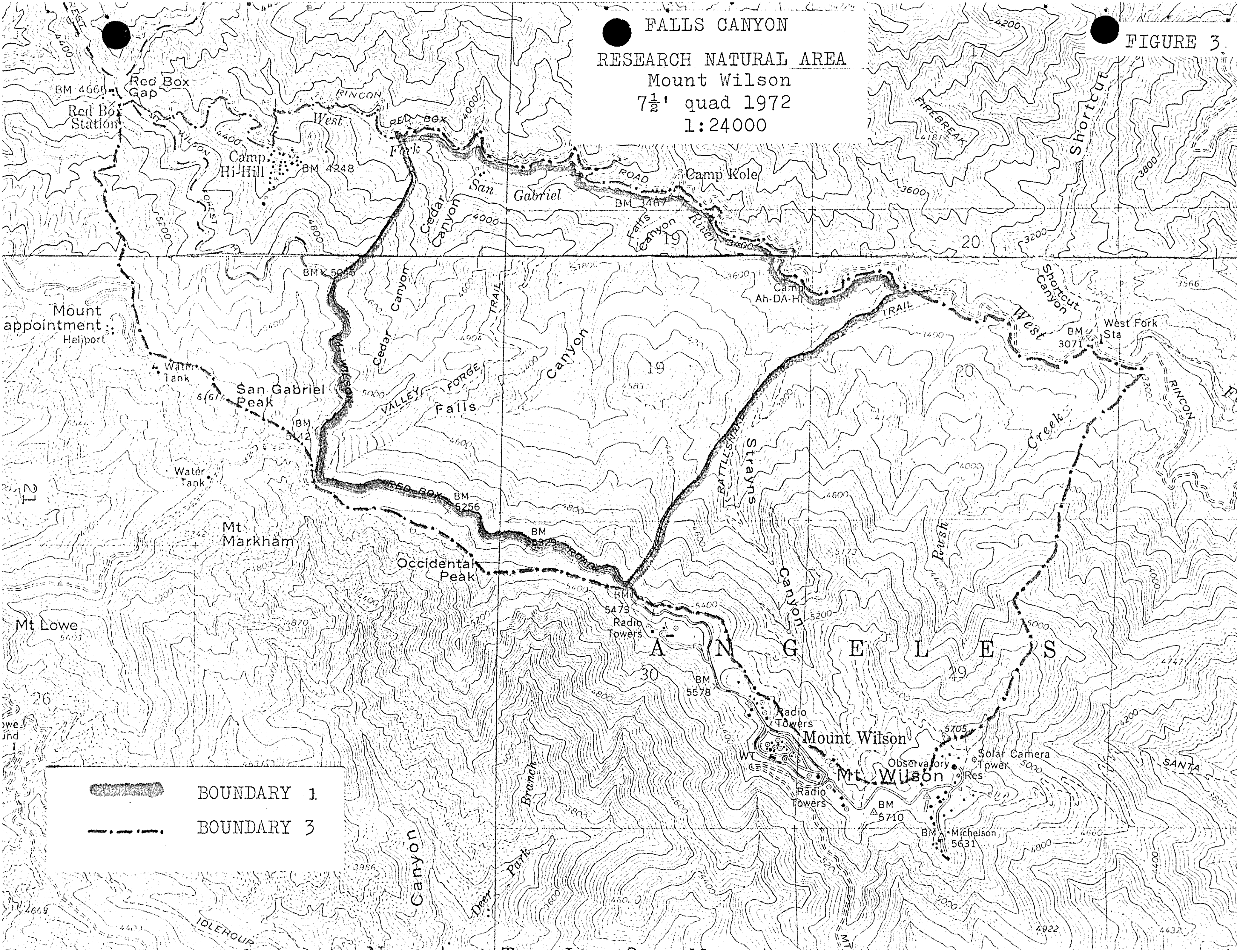

9-20-78 USDA 2 24 21 615010 278-202
FALLS CANYON R.N.A.
COLOR INFRA-RED AERIAL PHOTO 1:24000

FIGURE 3

FALLS CANYON RESEARCH NATURAL AREA

Mount Wilson
7½' quad 1972
1:24000



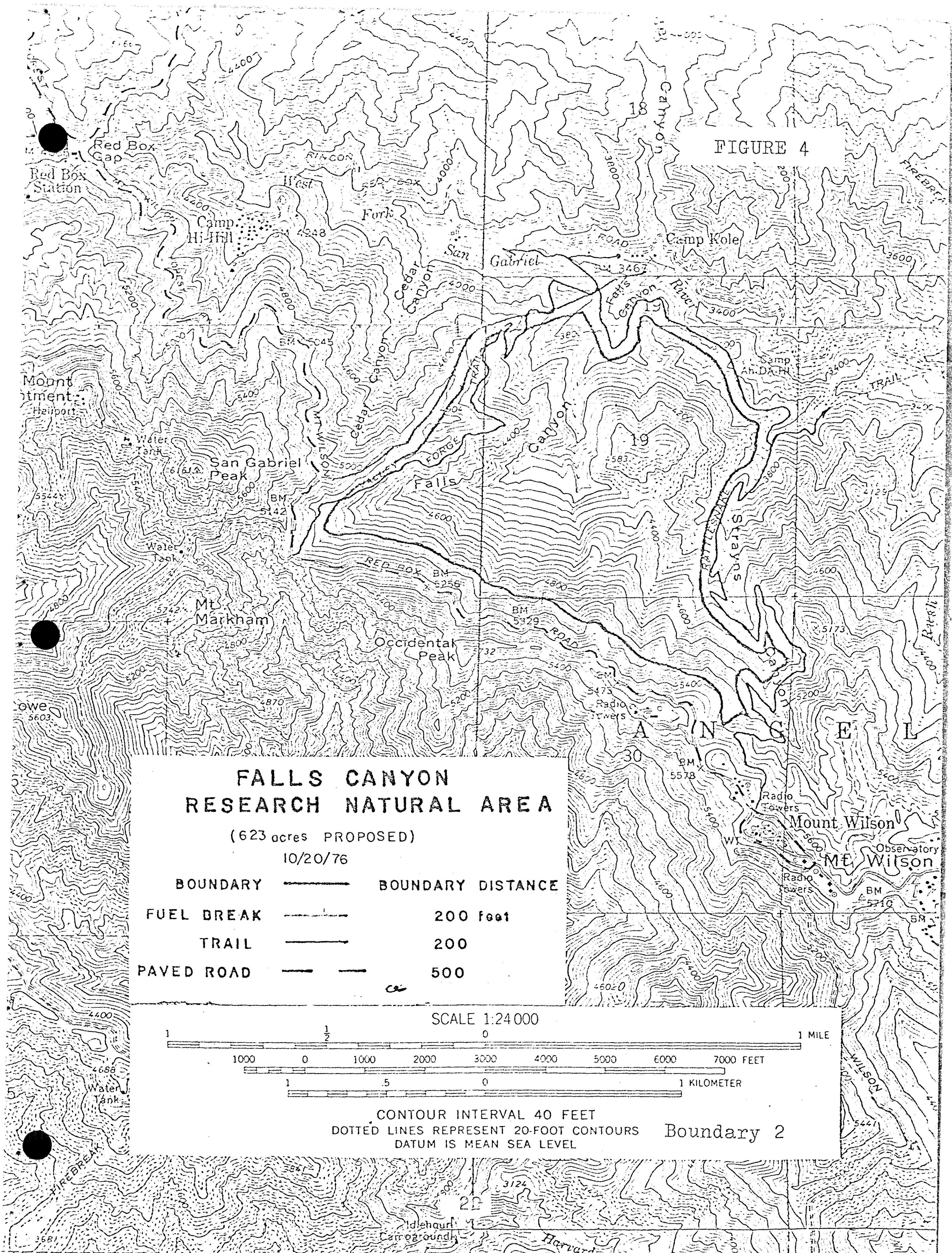
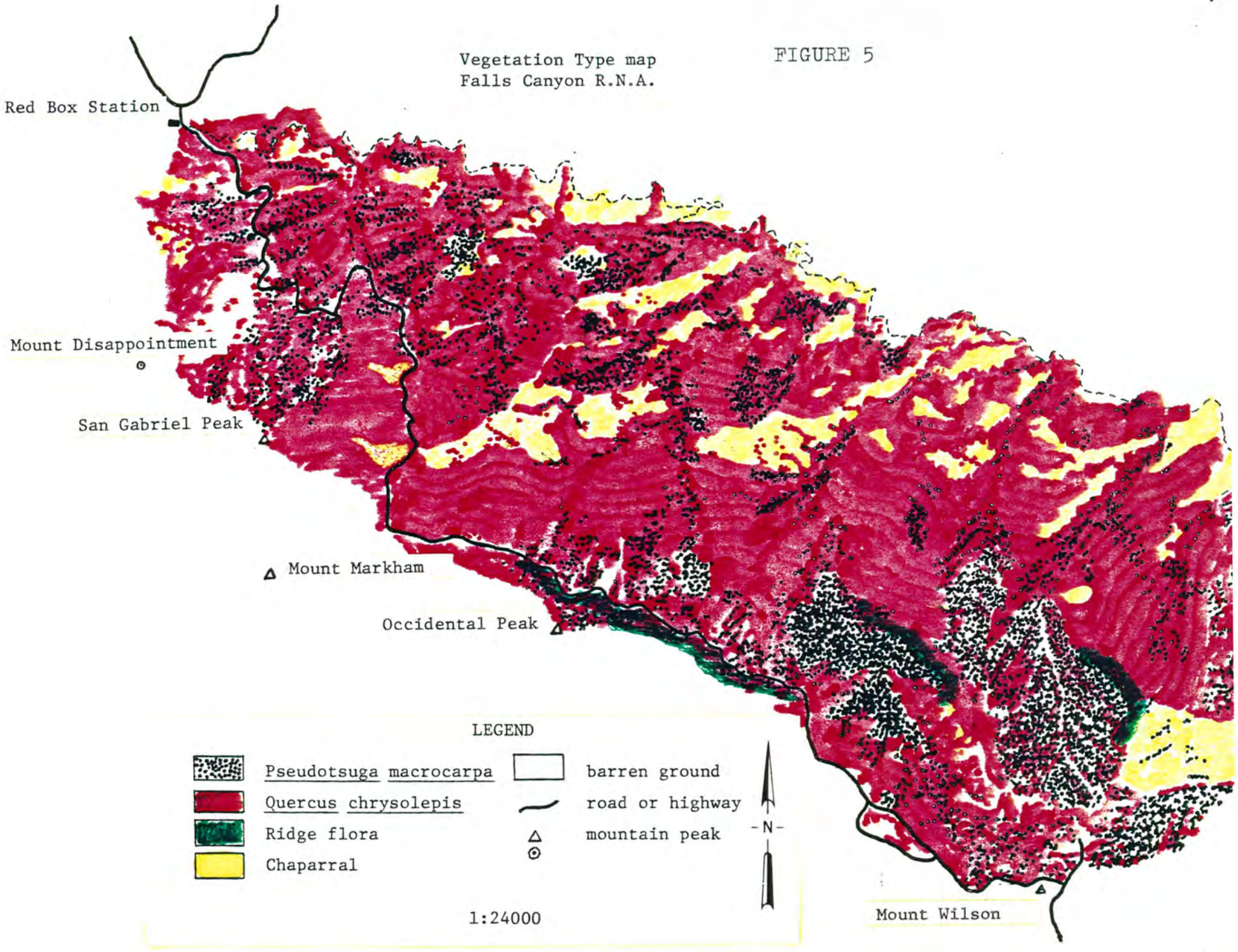
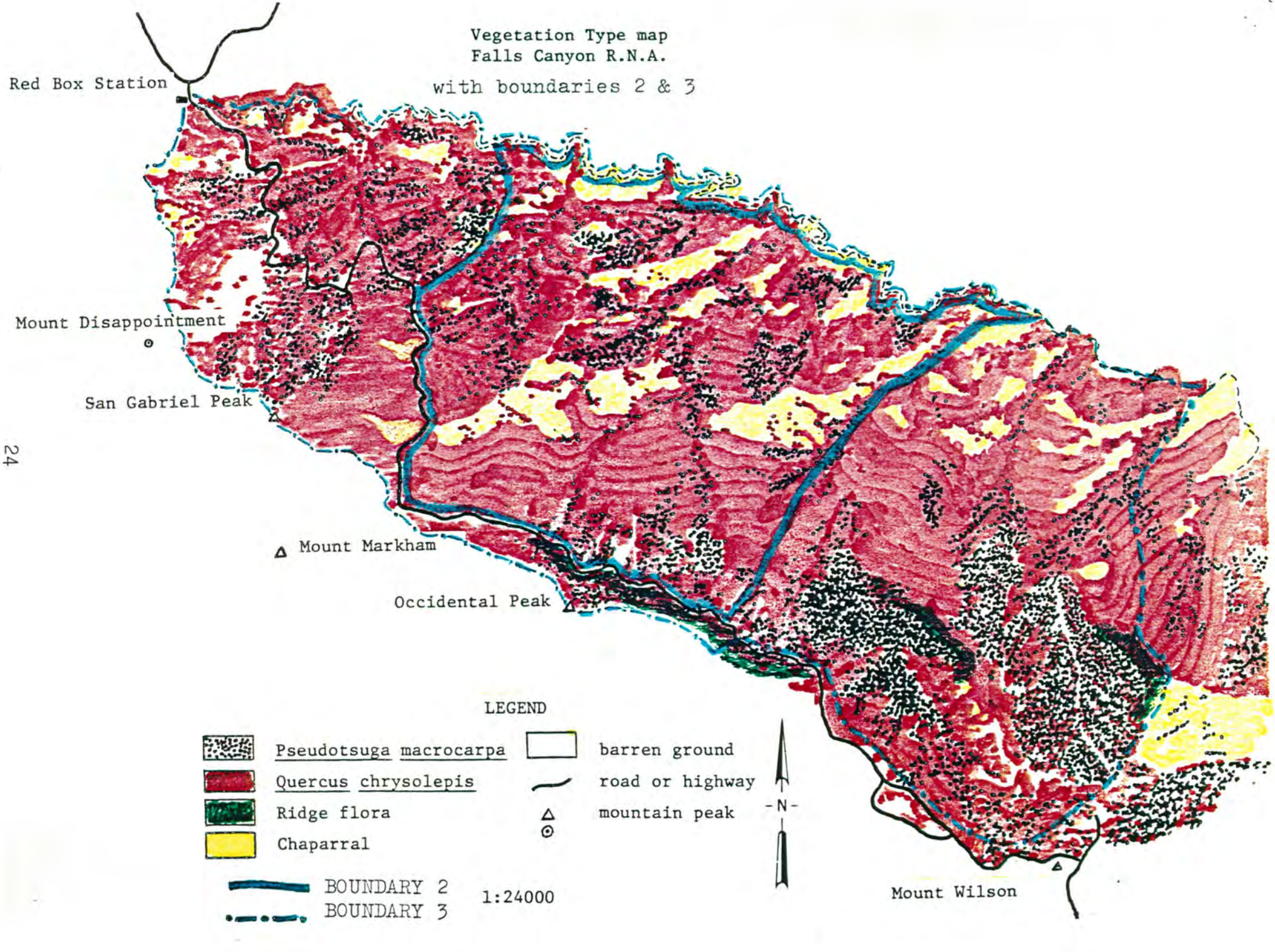


FIGURE 4
FALLS CANYON
RESEARCH NATURAL AREA
(623 acres PROPOSED)
10/20/76
BOUNDARY
BOUNDARY DISTANCE
FUEL BREAK
200 feet
TRAIL
200
PAVED ROAD
500
SCALE 1:24 000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
Boundary 2
Red Box Gap
Red Box Station
Camp Hi-Hill
West Fork San Gabriel River
Cedar Canyon
Camp Kole
Falls Canyon
Camp Ah-DA-Hi
San Gabriel Peak
Mt Markham
Occidental Peak
Strayns Canyon
Radio Towers
Mount Wilson
Mt. Wilson
Observatory
ANGEL
Water Tank
Heliport
Harvard

FIGURE 5

Vegetation Type map
Falls Canyon R.N.A.




Vegetation Type map
Falls Canyon R.N.A.
with boundaries 2 & 3
Red Box Station
Mount Disappointment
San Gabriel Peak
Mount Markham
Occidental Peak
Mount Wilson
LEGEND
Pseudotsuga macrocarpa
Quercus chrysolepis
Ridge flora
Chaparral
barren ground
road or highway
mountain peak
BOUNDARY 2
BOUNDARY 3
1:24000
-N-

APPENDIX 1

PLANT LIST OF THE FALLS CANYON AREA

Argemone munita Dur. & Hilg. ssp. munita. Prickly Poppy
Adenostoma fasciculatum H.& A. Chamise
Acer macrophyllum Pursh. Big-leaf Maple
Alnus rhombifolia Nutt. White Alder
Antirrhinum nuttallianum Benth. in DC. Snapdragon
Ambrosia pilostachya DC. var. californica (Rydb.) Blake. Western Ragweed
Arabis sparsiflora Nutt. in T.& G. var. arcuata (Nutt.) Roll. Rock-cress.
Artemisia douglasiana Bess. in Hook. Douglas' Mugwort
Artemisia dracunculus L. Tarragon.
Aralia californica Wats. Spikenard, California Aralia
Arctostaphylos glauca Lindl. Big-Berry Manzanita
Arctostaphylos glandulosa Eastw. ssp. glandulosa. Eastwood Manzanita.
Arceuthobium sp. Mistletoe
Asclepias californica Greene. Milkweed
Asclepias fascicularis Dcne. in A. DC.
Baccharis glutinosa Pers. Mule Fat
Boykinia rotundiflora Parry. Round-leaved Boykinia
Brickelia californica (T.& G.) Gray. California Brickelia
Bromus grandis (Shear) Hitchc. in Jeps.
Bromus rubens L. Red Brome
Bromus carinatus H. & A. Californa Brome Grass
Brassica geniculata (Desf.) J. Ball. Perennial Mustard
Bromus tectorum L. Cheat Grass
Bromus mollis L. Soft Chess
Calocedrus decurrens (Torr.) Florin. Incense Cedar
Castilleja martinii Abrams var. ewanii (Eastw.) N. Holmgren. Indian Paint Brush
Cercis occidentalis Torr. ex Gray. Western Redbud (cultivated)
Cercocarpus betuloides Nutt. ex T.& G. Mountain Mahogany
Ceanothus crassifolius Torr.
Ceanothus leucodermis Greene
Clematis lasiantha Nutt. in T.& G. Clematis
Claytonia perfoliata Donn. var. perfoliata.Miner's-Lettuce
Cryptantha circumscissa (H.& A.) Jtn. Popcorn Flower
Cistus villosus L. Mediterranean Rock-Rose
Clarkia unguiculata Lindl. Clarkia
Chrysothamnus nauseosus (Pall.) Britton. ssp. bernardinus (Hall) Hall & Clem. Rabbit
Camissonia boothi (Dougl. in Hook) ssp. rutila (Davidson) Munz.
Dicentra chrysantha (H.& A.) Walp. Golden Ear Drops
Delphinium cardinale Hook. Scarlet Larkspur
Dryopteris arguta (Kaulf.) Watt. Wood Fern
Dudleya cymosa (Lem.) Britton & Rose. ssp. minor (Rose) Moran. Live-forever
Ementhe penduliflora Benth. Whispering Bells
Eriodictyon tricocalyx Heller ssp. trichocalyx. Yerba Santa
Erodium cicutarium (L.) L'Her. Filaree
Eriophyllum confertiflorum (DC.) Gray var. confertiflorum. Golden Yarrow
Erigeron foliosus Nutt. var. foliosus. Fleabane
Eriogonum elongatum Benth.
Eriogonum fasciculatum Benth. ssp. foliosum Wats. California Buckwheat
Eriogonum saxitile Wats.
Epilobum sp. Willow-Herb

APPENDIX 1 (cont'd)

Fraxinus dipetala H.& A. Flowering Ash
Festuca sp.
Gayophytum heterozygum Lewis & Szweykowski.
Garrya veatchii Kell.
Galium angustifolium Nutt. Bedstraw
Gilia leptantha Parish ssp. leptantha.
Haplopappus cuneatus Gray.
Haplopappus parishii (Greene) Blake. Golden Fleece
Haplopappus squarrosus H.& A. grindelioides (DC.) Keck. Saw-toothed Goldenbush
Heuchera elegans Abrams. Urn-flowered Alum Root
Hulsea heterochroma Gray.
Juncus sp.
Keckiella ternata (Torr. ex Gray) Straw. ssp. ternata.
Lotus crassifolius (Benth.) Greene.
Leptodactylon californicum H.& A. ssp. glandulosum (Eastw.) Mason. Prickly Phlox
Lolium perenne L. ssp. multiflorum (Lam.) Husnot. Italian Ryegrass
Lonicera sp. Honeysuckle
Lotus purshianus (Benth.) Clem. & Clem.
Lotus argophyllus (Gray) Greene.
Lilium humboldtii Roezl & Leichl. var. bloomerianum (Kell.) Jeps. Humboldt Lily
Marrubium vulgare L. Horehound
Melica imperfecta Trin.
Mimulus longiflorus (Nutt.) Grant
Mimulus cardinalis Dougl. ex Benth. Scarlet Monkeyflower
Mimulus guttatus Fisch. ex DC. ssp. guttatus
Mentzelia laevicaulis (Dougl. ex Hook.) T.& G. Blazing Star
Orobanche fasciculata Nutt. Broom Rape
Polystichum scopulinum (D.C.Eat.) Maxon.
Pellea mucronata (D.C.Eat.) D.C.Eat. var. mucronata. Bird's Foot Fern
Phacelia brachyloba (Benth.) Gray.
Penstemon caesius Gray.
Keckiella cordifolia (Benth.) Straw. Heartleaf Keckiella
Phacelia imbricata Greene ssp. imbricata.
Potentilla saxosa Lemmon ex Greene.
Pseudotsuga macrocarpa (Vasey) Mayr. Big-Cone Douglas Fir
Pyrola secunda L. Pine Drops
Phacelia cicutaria Greene ssp. hispida (Gray) J.T. Howell.
Pinus coulteri D. Don. Coulter Pine
Pinus lambertiana Dougl. Sugar Pine
Pinus ponderosa Laws. Ponderosa Pine
Pinus attenuata Lemmon. Knobcone Pine
Prunus ilicifolia (Nutt.) Walp. Holly-leaved Cherry
Quercus dumosa Nutt. Scrub Oak
Quercus chrysolepis Leibm. Canyon Oak
Quercus kelloggii Newb. California Black Oak
Ribes roezelii Regel.
Ribes nevadense Kell.
Rhamnus californica Esch. Coffeeberry
Rhamnus ilicifolia Kell.
Rhus trilobata Nutt. ex T.& G. var. pilosissima. Squaw Bush

APPENDIX 1 (Cont'd)

Rubus leucodermis Dougl. ex T.& G. var. bernardinus (Greene) Jeps.
Selaginella bigelovii Underw. Fruit-o-the-Loom Spike Moss
Salix lasiolepis Benth.var. lasiolepis. Arroyo Willow
Salvia apiana Jeps. White Sage
Salvia columbariae Benth. var. columbariae.
Silene parishii Wats. var. latifolia Hitch. & Maguire. Catch-fly
Stipa coronata Thurb. in Wats.
Stipa sp.
Sambucus caerulea Raf. Elderberry
Sambucus mexicana Presl.
Sonchus oleraceus L. Sow Thistle
Stephanomeria virgata Benth.
Spartium junceum L. Spanish Broom
Senecio douglasii DC. var. douglasii.
Solidago californica Nutt.
Trichostema parishii Vasey.
Toxicodendron diversilobum (T.& G.) Greene. Poison-Oak
Turricula parryi (Gray) Macbr.
Umbellularia californica (H.& A.) Nutt. California Bay
Urtica holosericea Nutt. Nettle
Viola sp.

APPENDIX 2. Data From Increment Cores

	rings/ core	diameter basal ht. (")	approx. tree height (ft.)	ring width initial (")	(mm)	latest (")	(mm)
Strayns Canyon	384	40	100	0.04	(1)	0.02	(0.5)
	126	40	72	0.20	(5)	0.04	(1)
	122	13	20				
	115	27	34	0.08	(2)		
	51	18	35	0.08	(2)		
	42	3.5	7	0.04	(1)		
	279	26	90	0.06	(1.5)	0.01	(0.3)
	93	18	50	0.14	(3.5)	0.01	(0.3)
	101	11	20	0.10	(2.5)	0.03	(0.75)
	85	26	78	0.14	(3.5)	0.02	(0.5)
	75	25	60	0.16	(4)	0.04	(1)
Mt. Disappoint-ment	188	25	32	0.12	(3)	0.02	(0.5)
	95	9	23	0.06	(1.5)	0.02	(0.5)
	291	26	64	0.08	(2)	0.01	(0.3)
	300	25	90	0.06	(1.5)	0.01	(0.3)
	220	27	80	0.14	(3.5)		
	228	25	50	0.01	(2.5)	0.02	(0.5)
	193	23	55	0.08	(2)	0.02	(0.5)

SENSITIVE PLANT LIST

ANGELES NATIONAL FOREST

	Code	Scientific Name	REVD	Common Name	Clys
	ASBR-3	Astragalus brauntonii	2223	Braunton's Rattleweed	19,30
	CAPE-5	Calystegia peirsonii	2113	Peirson's Morning Glory	19
	CAGL-3	Castilleja gleasonii	2113	Mt. Gleason Paintbrush	19
*	CELE-4 (CHLE-2)	Centrostegia leptoceras (Chorizanthe leptoceras)	3333	Slender-Horned Chorizanthe	19,33,36
	CLLAP	Claytonia lanceolata var. peirsonii	3333	Peirson's Spring Beauty	19,36
	DUDE	Dudleya densiflora	2223	San Gabriel Mtn. Dudleya	19,33
*	ERMIJ	Eriogonum microthecum var. johnstonii	3113	Johnston's Buckwheat Brush	19,36
*	ERUMM-1	Eriogonum umbellatum var. minus	1213	Alpine Sulfur-Flowered Eriogonum	19,36
*	GAGR-2	Galium grande		San Gabriel Bedstraw	
*	ORVA	Orobanche valida	3113	Rock Creek Broomrape	19,36,56

This list supercedes all similar lists bearing earlier dates. It is subject to change as new information becomes available.

* Proposed rule-making is in effect for classification as Endangered.

Rare Species (State) (Continued)

Amphibians

Black toad	NF
Siskiyou mountain salamander	NF
Limestone salamander	NF
Shasta salamander	NF
Kern Canyon slender salamander	NF
Tehachapi slender salamander	NF

Fishes

Modoc sucker	NF
Rough sculpin	NF
Cottonball Marsh pupfish	

SENSITIVE SPECIES (FOREST SERVICE)[2/]

Mammals

- Tule elk
- Nelson bighorn
- Mt. Pinos chipmunk

Birds

- Prairie falcon
- Osprey
- Spotted owl
- Golden eagle
- Goshawk
- Mt. Pinos blue grouse

Fishes

- Little Kern golden trout
- Redband trout
- Dolly Varden trout
- Summer steelhead

Crustaceans

- Placid crayfish

APPENDIX 4. Revised Angeles National Forest
Sensitive Plant List - potential

Horkelia wilderae Parish.
Galium californicum H & A primum Demp. & Steb.
Eriogonum microthecum Nutt. var. johnstonii Reveal.
Eriogonum umbellatum Torr. var. minus I.M. Johnston.
Claytonia lanceolata Pursh. var. peirsonii Munz & Johns.
Lilium parryi Wats.
Arabis johnstonii Munz.
Cordylanthus eremicus (Cov. & Mort.) Munz. ssp. bernardinus.
Leptodactylon jaegeri (Munz) Wherry.
Lilium fairchildii Jones.
Berberis nevinii (Gray) Fedde.
Thelypodium stenopetalum Wats.
Mimulus exiguus Gray.
Mimulus purpureus Grant var. purpureus.
Streptanthus bernardinus (Greene) Parish.
Phlox dolichantha Gray.

Appendix 5

Mount Wilson Ridge - view from Angeles Crest Highway toward south

(foreground from two perspectives)

Appendix 5 (continued)

Photograph from near Mount Wilson of Pine Crest fire damage

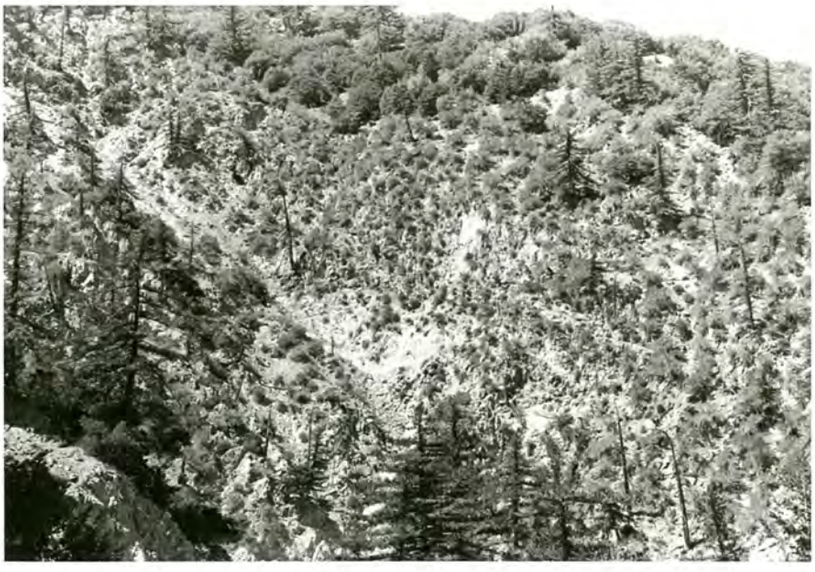
(taken 1980)

Big-Cone Douglas Fir depleted by fire, near Angeles Station;

typical of the loss of this vegetative type throughout its range.

Appendix 5
(Continued)

Big-Cone Douglas Fir resprouting from bole,
Mount Disappointment



Big-Cone Douglas Fir in uncommon association with chaparral

Appendix 5
(continued)

Big-Cone Douglas Fir in Strayns Canyon, 54 inches in diameter and about 100 feet tall

Densest phase of Big-Cone in Strayns Canyon, about 53 per acre

Appendix 5 (continued)

Dudleya cymosa ssp. minor part of 'Ridge Flora' in Strayns Canyon

Heuchera elegans (Urn-flowered Alum Root) in Strayns Canyon